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ABSTRACT

This study explored children's changing conceptualizations of goal as they engaged in repeated sessions of strategy game set-up and play. Twenty-four children, aged 7 to 9, were divided into 2 groups. Each participant in the first group played a novel strategy game once a day for 5 days. Measures of game performance were collected from this group. Each participant in the second group also played five games of the same novel strategy game; however, the researcher asked questions about participants' plans and goals for the game in three task phases within each session. Participants' goal conceptualization was measured using researcher-created hierarchies of goal development at multiple levels of analysis. The study investigated: (1) the relationship between children's verbalized goal conceptualization at multiple levels and game play performance; (2) the influence of the sociocultural context; (3) the influence of researcher questions on performance; and (4) patterns of change in goal conceptualization. A relationship was found between goal and performance. Findings also show several contextual influences that were conducive to more advanced goal conceptualization, and that researcher questions did not influence children's performance. Four general patterns of goal change were identified, reflecting variability in the development of children's goal conceptualization. Findings suggest an integrative, multilevel approach to examining goals, and they strengthen the link between motivation and cognition. Three appendixes contain an overview of the goals, the questions by task phase, and a discussion of goal and performance measures. (Contains 4 tables and 28 references.) (SLD)

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Running head: DEVELOPMENT OF GOAL CONCEPTUALIZATION

The Development of Goal Conceptualization in Activity

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Abstract

This study explores children's changing conceptualization of goal as they engaged in repeated sessions of strategy game set-up and play. Twenty-four children, ages 7-9, were divided into two groups. Each participant in the first group played a novel strategy game once each day for five days. Measures of game performance were collected from this group. Each participant in the second group also played five games of the same novel strategy game; however the researcher asked questions about participants' plans and goal for the game in three task phases within each session. Participants' goal conceptualization was measured using researcher-created hierarchies of goal development at multiple levels of analysis. The three-level analysis was based on Soviet approaches to defining goals. This study investigated four major issues: (a) the relationship between children's verbalized goal conceptualization at multiple levels and game play performance; (b) the influence of the sociocultural context, in this case the task phase, on children's goal conceptualization; (c) the influence of researcher questions on children's performance, and (d) patterns of change in children's goal conceptualization. A relationship was found between goal and performance. Findings also identify several contextual influences that were conducive to more advanced goal conceptualization. Researcher questions did not influence children's performance. Finally, four general patterns of goal change were identified. These patterns reflected variability in the development of children's goal conceptualization. Findings suggest an integrative, multilevel approach to examining goals, and further strengthen the link between motivation and cognition. For practitioners, the design of curriculum and learning environments should be informed by an awareness of the complexity and dynamic nature of children's goals.

The Development of Goal Conceptualization in Activity

This study examines the changing conceptualization of goal as 7-9 year olds learned and repeatedly competed in a complex strategy game. More specifically, the study focuses on the process of goal formation and change at multiple grain sizes and across different contexts as shifts occur within an individual's activity. In the research traditions that have studied individual's goals, goal is viewed as an independent variable with multiple, modifiable characteristics influencing motivation, cognition, and performance; that is, an individual can "have" a goal and that goal structures the environment. As research has progressed, it has become increasingly clear that goals are far more complex than these views acknowledge. A central premise of the current study is that goals emerge and develop through the interaction between individual's conceptualization and the context within which they are engaged. In the course of activity, goals appear to be dynamic and multifunctional – shifting form and function as activity in context ensues.

While current lines of research have been fruitful within distinct perspectives, complex phenomena that cut across perspectives, such as goal, may require a more integrated approach. As current researchers attest, some of the most basic questions about goal remain: What are goals, and how do goals form (Ames, Blumenfeld, Dweck, Maehr & Urdan, 1996)? Fortunately this shift to integrating knowledge has begun as researchers have recently combined work regarding motivation and goals with knowledge of cognitive development (Ames, Covington, Elliott, Harackiewicz, & Pintrich, 2001). For example, Pintrich explained one future pursuit should be to examine "...how goals play out in the dynamics of developing expertise." (Ames, et al., 2001).

This study investigates how children develop their conceptualization of a goal within the shifting context of their developing knowledge of a task using the Soviet activity theory as a model for analysis. The activity theory model provides an analytical framework that integrates multiple lines of goal research, thus providing a start to understanding the complex function of goals.

Theoretical Framework

There have been many approaches to explicating goal. The idea of goal as end-state towards which behavior is directed is well known and accepted as fundamental to psychological theory; yet the ubiquity of that perspective may have unnecessarily limited the full picture. Motivation theory, which supports this perspective, presumes that goals originate and reside in the individual (Locke & Latham, 1994). However, other perspectives note that thinking is modulated by context. For example, both cognitive and sociocultural perspectives view goals as emerging from an individual's interactions within the structures and constraints that exist in an evolving social system, including the task, the interactions, the language, the physical set-up and other factors (Cobb & Bowers, 1999; Leake & Ram, 1995; Saxe, 1991). As Saxe (1991) explains, "Within practices, goals emerge that must be accomplished, avoided, or reckoned within the achieving of larger objectives." (p. 186)

Goal in Motivation

Two distinct agendas have emerged in goal research from a motivation perspective: goal theory and goal-orientation. The goal theory agenda has pursued the influence of specific goal characteristics (such as specificity or difficulty) on performance pursuant to the goal. Goal theory research centers on the idea of goal-setting. Individuals can impose goals upon themselves or be subjected to goals that others impose. Researchers seek to identify attributes of goals that increase performance, particularly intrinsically motivated or self-regulated performance. Goals that are specific, proximal, moderately difficult, important, clearly explained, and possible to achieve have been found to increase performance (see Locke & Latham, 1994 for a summary of goal theory).

The goal-orientation agenda, on the other hand, explores the conditions leading to, and performance effects of, a more pervasive goal, i.e., a goal that influences many aspects of thought and behavior. This is contrasted with goal theory's emphasis on a specific end for a specific task in that goal-orientation defines the end applied across many different tasks. "Each goal, in a sense, creates and organizes its own world – each evoking different thoughts and emotions and calling forth different behaviors," (Elliott & Dweck, 1988, p. 11). Goal-orientation has been studied in the context of achievement motivation, i.e., goal-orientations that lead to achievement-driven patterns of motivated behavior. Numerous goal orientations have been identified; however all types are based on subjects' reasons for motivated behaviors. For example, a performance goal-orientation is based on an individual's desire to outperform others. Additional reasons identified by theorists include individuals' desire to learn more, avoid work, make friends, perfect performance, acquire a reward, and so forth (Elliott & Dweck, 1988; Ames & Archer, 1988; Dweck, 1986; Nicholls, 1984).

From the motivation perspective, goal appears to provide structure and guidance to cognition, and influences motivated behavior. The motivation perspective assumes that the goal exists in the individual as an independent, pre-developed construct. Motivation research does not account for where goals come from, how they develop, or how they fit into the interaction between person and task. These questions are central to understanding learning and development.

Goal in Cognition

The cognitive approach has evolved to emphasize the link between person and task. Early research on problem solving (Simon & Simon, 1978) and theories of cognitive representation (Klahr, 1976; Anderson, 1982) viewed goals as residing in the task; that is, goals were not realized until an individual interacted with the task. More current cognitive theorists view goals as emerging from individuals' conceptualizations as those conceptualizations are continuously revised through interaction with the environment (e.g., Leake & Ram's (1995) deficit reduction theory).

The cognitive approach focuses on goal emergence and development as a function of an individual's interaction with a task. While the cognitive approach provides clarity to the process, it remains limited in its incorporation of the broader context that influences goal. Cognitive research does not focus on the contribution

of social interactions or the extent to which contextual artifacts are incorporated into individual conceptualization, and thus goal.

Goal in Sociocultural Theory

A third approach, sociocultural theory, offers additional structure for understanding how goals function. The sociocultural perspective highlights the social and historical nature of collective activity as central to human development. Individual consciousness is comprised of the internalized character, content, and form of the sociocultural milieu in which one operates. And the development of this consciousness can only be accomplished by active participation in social interaction. Through social interaction the basic forms of activity in the culture are internalized, subsequently guiding future activity. Vygotsky (1986) emphasizes this point, stating, "The child's intellectual growth is contingent on his mastering the social means of thought, that is, language"(p. 94).

Like the cognitive perspective, sociocultural theorists' focus on the relationship and dynamics between an individual and the environment is critical to explaining goal. However, a sociocultural perspective views that relationship as constantly evolving, and consequently views goal as a malleable construct that emerges from the co-constitution of individual conceptualization and the sociocultural context (Cobb & Bowers, 1999). This relationship, which has important implications for goal, has its origins in the Soviet activity theory.

The sociocultural approach makes two additional contributions to an explanation of goal: the importance of analyzing human activity at multiple levels, and the emergent nature of goal resulting from the reciprocal influence between individual and context. Within the Soviet theory of activity Leontiev (1981) emphasizes three levels of analysis: the individual's specific sociocultural, historical context (activity), their immediate objectives within that context (action), and specific actions they engage in (operations). The theory of activity labels these three levels of analysis activity, action, and operation, respectively. The ultimate goal of the theory of activity is to understand the relationships among these three levels. *Activity, action, and operation constitute three levels of analysis, not three distinct components or processes*. None of the three exists independently, just as the individual, the sociocultural context, and activity are viewed as interdependent aspects of the same whole.

Integrating Perspectives

The operation of goals at multiple levels may explain much of the confusion and difficulty researchers have had in attempting to define and describe goals. The fact that goals are dynamic adds to the difficulty. Without a multi-level lens, researchers have extracted pieces of the whole and expanded them into a variety of related constructs. For example, research that conceives goal at an activity level tends to regard goal as a static construct such as life task (Cantor & Kihlstrom, 1989), personal striving (Emmons, 1988), purpose, or goal-orientation. On the other hand, research viewing goal at the action level focuses on a construct of a different grain size such as a sub-goal (Locke & Latham, 1994), strategy (Siegler & Jenkins, 1989), or end-state. A multiple-level perspective allows one to differentiate between goal as sociohistorically informed motive, goal as

strategy, and goal as operation, and consequently more accurately describe goal change and the activities involved in that change.

The current study utilizes this multi-level perspective to track the emergence and development of a goal as children engage in repeated episodes of a strategy game. Following on sociocultural activity theory, three levels of analysis are identified based on different grain sizes from which one might view the activity: the goal level, the activity level, and the tool level (Leont'ev, 1981). The goal level focuses on an individual's understanding of goal as embedded in the context. At the goal level, one's conceptualization of goal represents the sociohistoric background he or she brings to the situation, as well as the sociocultural influences of the immediate context. The objective of the strategy game strongly asserts itself in individual's goals; however, the goal level conveys the situated nature of playing the game, couched chronologically between contexts that may forward different aims.

The activity level views goal relative to the task environment, evolving to understand goal as activity within a system of interrelated influences. At the activity level, one's conceptualization of goal might involve understanding the relationship between goal, conceptualization of the task, perception of context, and current activity. The context of goal comprises specific plans, strategies, or heuristics.

Finally, at the tool level, goal is viewed as the set of tools that enable goal achievement. Much like the operations level in the theory of activity, the tool level focuses on the means by which an end is reached. At this level, tools transition from ends to means as they become internalized within the developing goal. Strategy games often involve artifacts such as game pieces that serve to define the rules of play. However, the tool level dictates that such artifacts contribute to the achievement of objectives through their service of framing activity. The transition from artifacts to useful tools reflects the development of goal at this level.

As a system, the three levels of analysis might be clarified using a metaphor of a rowing ship. Suppose that the ship is on the sea and the desired task is to reach land. On board there are three levels of crew. Endowed with the wisdom of experience, the decision-makers at the goal level choose the destination. Their decision, however, is useless without the navigators, who represent the activity level. The navigators designate a position and direction based on the relationship between the ship, the destination, and what lies in between. But to achieve the destination, one still needs the rowers, whose operation of tools moves the ship toward the destination. None of these levels functions without the others, but regarding the levels as distinct helps one analyze why and how the destination is or is not achieved.

Current Research on Goal Development

Research in the motivation, cognitive, and sociocultural perspectives informs us that goals guide cognition and motivation, emerge as individuals interact with a task, and are informed by multiple sources in an evolving context. Some theorists have begun to explicate the form and function of goal with this multifunction perspective.

Zinchenko (1981) asserts that an activity starts as a goal, and once automatized, serves as a means to other goals. Through interactions within the sociocultural context, the form of one's understanding and the function of one's cognitive activity bootstrap off one another in a dynamic process of development. Cognitive adaptation to the changing demands of the sociocultural setting is a gradual process of form-function interplay that utilizes goal adaptation to inform cognition and in turn, changes the goal. This view is consistent with current research on knowledge acquisition, which asserts that individual's activity and their conceptualizations reciprocally influence one another in a process of continuously developing cognitive theory-building (Kuhn, Garcia-Mila, Zohar, & Andersen, 1995).

Similarly, in a game-play context, Billman and Shaman (1990) found that both the actions and problem representations of problem-solvers evolve from concrete goals to abstract as players attain expertise. As they assert, "In Othello, Go, checkers, and chess, strategy shifts from a very concrete, directly observable goal (capture of pieces or control of squares) to a more abstract goal of restricting the opponent's ability to move or of influence over territory"(p. 163). Thus, activities that facilitate knowledge acquisition and the development of expertise also help shape goal.

As individual conceptualization of goal evolves, the influences of the on-going context continue to shape and reshape an individual's goal. Researchers have clarified some of the contextual elements guiding goal development. Saxe (1991) claims that goals emerge from the interaction between an individual's prior understanding, the structure of the activity, social interactions, and other conventions and artifacts comprising the context. Saxe does not, however, differentiate among these influences in terms of explicating their role at different points of goal development.

The findings of Newman, Griffin and Cole (1989) are generally consistent with Saxe's assertions. Newman, et al., studied children's cognitive processing and goal-directed behavior in two tasks designed to elicit the same cognitive strategies. Newman, et al., found that the goal imposed by the teacher was not directly adopted. Instead, children's goals were driven by the task, their interactions with other students, their interaction with the task as revealed by self-verbalizations, and the interactions with the teacher. Goals result from children's "...active appropriation of available cultural resources"(p. 58). However, Newman et al., suggest that the influence of the teacher's goal, "...may be a useful way of importing the goal into the teacher-child interaction and from there into the child's independent activity"(p. 56).

The Process of Goal Development

Goals evolve within the individual, and interact with and evolve within the sociocultural context. A limited number of theorists examine how goals develop within this process, changing form and function as understanding develops. The most readily apparent aspect of goals is their function. As evidenced both theoretically and anecdotally, goals focus and guide cognition and behavior. These functions vary, however, as goal evolves within the changing sociocultural context and one's changing conceptualization.

Theorists assert two areas of function change in evolving goals: the level of goal focus and the complexity of goal conceptualization. The bootstrapping development between cognitive form and function is guided by goal at different levels as individual understanding of a task develops. Goal develops in such a manner that the focus of goal changes to better support the next stages of learning. Saxe (1991) asserts that social artifacts first support goal-directed activity and then move on to become goal-directed cognition. As Saxe states, "...what was once a social artifact external to the child, is gradually transformed by the child, first into an external aid which helps organize problem solving and later into a core ingredient of conscious thought" (p. 9). In other words, as a novice, individuals focus on operations-level functions of goal, utilizing contextual tools to support understanding. As knowledge is acquired, the use of these tools becomes part of one's conceptualization. For example, novice chess players focus on the movement rules for each type of piece, all in the service of capturing pieces and ultimately putting the king in checkmate. Chess experts, however, while sharing the same goal of putting the king in checkmate, utilize the pieces as parts of multi-piece, multi-move configurations aimed at limiting the opponent's options for movement. Consequently, the change in strategy from concrete to abstract explained by Billman and Shaman (1990) results from the evolving focus of goal to more abstract facets of the task and context. Zinchenko (1981) adds that these evolving goals consequently assist selective attention and recall of goal-relevant information. The changing focus of goal adjusts that which would be considered 'goal-relevant.'

The on-going research regarding the development of expertise may illustrate this phenomenon. One perspective of expertise development asserts that expertise is attained by an increasingly greater ability to recognize patterns in the task that lead to success. An alternative view asserts that a qualitative cognitive change occurs in how individuals conceptualize the task. Billman & Shaman (1990), however, hint that the development of expertise may be indicative of the changing nature of goal. They suggest that early in expertise development, the goal focuses at the tool level, which emphasizes pattern recognition. As expertise develops, the focus of goal shifts to the goal level, emphasizing global reconceptualization.

Goals enable and constrain the range of behavior options, both motivationally and cognitively. An individual's conceptualization of the goal, which includes how to achieve the goal, creates parameters for activity. At the most uninformed level, goal is actualized in the most direct activity presumed to reach the end-state. As experience grows the stated goal may remain the same, but the individual's full conceptualization of that goal will have grown more complex, thus enabling and constraining activity to a more successful result.

Some studies elucidate the process of goal change. The students in Schauble's (1990) study show evidence of the interplay between conceptual development and goal development. In a follow-up study, Schauble, Klopfer & Raghavan (1991) compared students' strategies and activities under two different models of experimentation: the engineering model with the goal of optimizing an outcome, and the science model with the goal of finding the relationship between variables. They found that the goals of the first task tended to

initially carry over to the second task, even if the carried over goal was contrary to the goal indicated by the task, thus illustrating a lag time in the adaptation processes of goal change as well as the guiding role of goals.

Schauble, et al. also found that student's goals and activity naturally shifted as the student's expertise grew. Performance was optimized for students whose task order complemented the expertise-driven evolution of goals. However, development was not a linear process; it was characterized by a great deal of local vacillation with change over time. Siegler and Jenkins' (1989) work on strategy use and development found this same phenomenon at the action level of goal analysis. They found that while subjects used different strategies upon repeated measures of the same problem, those strategies were not ordered by level of complexity. When a new, more advanced strategy did appear, subjects' use was gradual and intermittent, like a series of building waves. Further, Siegler and Jenkins also explain three common behavioral patterns preceding the discovery of a new strategy: (a) longer solution times, (b) a specific transitional strategy that incorporates features of both old and new strategies, and (c) an inability by the subject to articulate the strategy upon initial use. Kuhn, et al. (1995) purport a similar pattern in knowledge acquisition, describing the process as "...coordinating theories and evidence. New knowledge does not simply add to or displace existing knowledge; new and old must be coordinated and reconciled"(p. 106).

The reciprocally influential relationship between the individual and the context is critical to understanding goal. Crowley and Siegler (1993) suggest that the task may dictate a specific order in which expertise, and consequently goal, develops. The work of Crowley and Siegler on the development of strategy flexibility in open task environments illustrates how individuals' strategy use develops relative to the inherent properties of the task. Using the game tic-tac-toe, Crowley and Siegler found that children learned strategy rules for the game in the order of strategy complexity, and subsequently applied those rules to game play decisions in that order. Experienced players appear to change the order in which strategy rules are applied to flexibly adapt their strategy use to game play decisions. However, Crowley and Siegler found that players maintain their strategy rule order and achieve flexible strategy use by adjusting the amount of time they spent examining each strategy rule for applicability to the new decision.

The work of Crowley and Siegler (1993) illustrates the changing form of goal within the shifting cognitive and contextual landscape of activity. Crowley and Siegler found that when people are novices, game play is slow and resource demanding as players carefully weigh the situation against their conceptualization. As players acquire experience, decisions are faster and require fewer cognitive resources, as they begin to draw on past experience with the game. The trade-off, as Crowley and Siegler show, lies in goal flexibility and attention to context. As players develop experience, their greater reliance on prior learned strategies focuses their strategy rule applicability search more on their conceptualization and less on the context. Consequently, experienced players are better able to maintain their focus on the overall goal, but are more susceptible to missing atypical details that might arise in the context.

In sum, a process of continuous adjustments characterizes goal development as goal adjusts to the evolving context and the individual's changing conceptualization. Further, the nature of the adjustment process changes as individuals acquire a more complete conceptualization of context.

Procedures and Research Questions

This study used a microgenetic method to examine participants' changing conceptualization of a goal within three levels of analysis and across four different contextual phases of a task (Siegler & Crowley, 1991).

Twenty-four children (ages 7-9), inexperienced players of the strategy game Stratego, were assigned to one of two groups, a "Question Protocol" (QP) group and a "Game Play Only" (GPO) group. In both groups each child played a game of Stratego once a day for five days against an experienced opponent. The Stratego game offers complexity complementary to analyzing participant goals at multiple grain sizes and is representative of the class of strategy games. The object of the game is to capture the opponent's flag by outmaneuvering and/or defeating opposing pieces. The game is sufficiently complex so that children can develop sophisticated set-up and play activities, yet novices can also play the game immediately after learning basic rules of play. An overview of the game, pieces, rankings, and game rules is provided in Appendix A.

For purposes of analysis, children's activity was viewed across two dimensions. First, activity was ordered chronologically by five task phases. Different kinds of information with respect to participants' goals were obtained during each phase. Furthermore, each phase entailed different sociocultural influences that contributed to goal development. Data were collected during the following five task phases. The *pre set-up phase* lasted from the child's arrival until he or she began setting up. Children set up the game during the *set-up phase*, and were then asked questions during the *post set-up phase*. Following questioning, the arrival of the opponent and ensuing game play comprised the *game play phase*. Finally, following game play the participants were asked more questions during the *post game play phase*.

The second major dimension of analysis follows the threefold analytic scheme suggested by activity theory. At each task phase, data were coded at the tool, activity, and goal levels of analysis. The three levels of analysis enable one to view goal development at different grain sizes within a single task phase, providing a picture of goal complexity. The *tool level* focuses on participants' understanding of the means to the goal, via the use of task artifacts like pieces and regions of the board. The *activity level* focuses on participants' ability to conceptualize goal in a dynamic context, accessing and coordinating one's own strategies with those of the opponent and other evolving aspects of the game. The *goal level* focuses on the sociocultural influences that establish a given goal in a given context. A major issue at the goal level is how the different task phases affect one's interpretation of the goal.

The two dimensions, task phase and grain sizes or levels of analysis, can be coordinated in a grid with five task phases and the three levels of analysis. The grid, therefore, has a total of 15 cells, although not all cells were explored in this study, because all three levels of analysis were not necessarily investigated during each of the five phases of the task. Table 1 provides an overview of all measures within the two dimensions.

Goal Conceptualization Measures

One important index to how children were thinking of their game play is their explanations about their intentions at various task phases during the session. These explanations included both spontaneous comments during game phases and replies given to the specific questions asked by the interviewer.

In the QP group, each child was asked a series of standard questions about his or her goals and plans throughout three of the five phases of the task (see Appendix B). The children in the GPO group were not asked these questions, but rather served as a control group to assure against researcher influence. All phases of the task and participant interviews were audio and video recorded for later analysis. Children's replies and explanations were scored on two hierarchical category systems, one for the tool level of analysis, and one for the activity level. These scores are collectively called *goal conceptualization measures*, reflecting the assumption that what children *say* about their plans and strategies is one important aspect of their understanding of goal. Because these measures were based on replies to questions, goal conceptualization data were collected only from the QP group.

Ranked hierarchies for goal conceptualization (children's statements), and performance (game set-up and game play), were constructed based on pilot work and past research findings to provide a measure of goal that reflected participants' developing conceptualization of goal, in thought and performance, at both the tool and activity levels (see Appendix C, Tables 1 and 2).

Tool Level Hierarchy Rank.

The tool level hierarchy centers on individuals' increasing ability to utilize the artifacts of the task (e.g., pieces and game board regions) as tools to achieve the overall goal, and has six major ranks. At the least developed level (Level 0 - No response), players fail to respond to queries about goals. At level 1 (Unguided tool use), the player describes moves that honor the rules of the game but do not apparently point toward a plan. In other words, the main consideration appears to be simply moving pieces around the board. At level 2 (Tools with immediate goals), the player describes local goals that seem to be defined entirely by the capabilities of the piece at hand. For example, the player might use a "3" appropriately to defuse a bomb. However, there is no evidence that the plan extends beyond this local goal.

Level 3 represents the most critical transition in the child's developing conceptualization of goal at the tool level. At level 3 (Tools with subgoals), the player talks about using more than one piece to pursue a local goal. Children are moving from conceiving the game pieces as having independent, local goals, to seeing the pieces as tools to accomplishing a more global goal.

At level 4 (Tools used as means to end), players begin to talk about using pieces in a coordinated manner to achieve a more global goal, such as acquiring the flag. And, at level 5 (Own and opponents' tools), a player also takes account of the opponent's pieces in formulating their plan, using the opponent's pieces, as well as their own, as tools to achieve a global goal.

Activity Level Hierarchy Rank

The activity level hierarchy is based on individuals' descriptions and explanations of their own and their opponents' strategies and plans. Instead of talking about moving game pieces, as they did on the tool level, here children talked about more global intentions, for example, to chase, attack, defend, stall, or deceive. This hierarchy reflects how children account for the task, the opponent, and their own strategies and plans. Like the tool level hierarchy, this one also has six levels.

At level 0 (No response), a player gave no reply to the interviewers' questions. At level 1 (Task without goal), a player's verbalizations did not include any evidence of a plan. Instead, players talked about following rules, or parroted the objective of the game. At level 2 (Local strategies), children talk about very local strategies, such as chasing a piece to acquire it, confronting an invading piece, or simply attacking "blind," that is, with no knowledge of the pieces being attacked.

Level 3 players (Emergence of a plan) are beginning to verbalize limited awareness of the opponent's plans and the ability to organize limited global plans. For example, they may talk about defending particular areas of the board because they believe the opponent intends to attack them, or attend to both offense and defense. As for the tool level hierarchy, level 3 represents the most critical transition in how children conceptualize their goal. At level 3 children begin to transition from focusing on local goals to maintaining focus on the global goal. The distinction at the activity level of analysis lies in the change to children's game play strategies, rather than a change in their conceptualization of the game pieces as at the tool level of analysis.

By the time a player is classified as level 4 (Goals becoming flexible), he or she is describing plans as contingent on the game as it plays out. For example, participants talk about discovering and keeping track of the changing configurations of the opponents' pieces. At level 4 children also begin to express the use of goal to manipulate their opponent's thinking. They begin to describe their opponent's goal as a flexible tool that can be manipulated. At level 5 (Goal flexibility), players explicitly state deceptive plans, usually by trying to communicate a false plan to the opponent. Planning and executing deceit in the context of game play requires an advanced ability to flexibly adapt goal to changing situations and opportunities.

The tool level and activity level hierarchies parallel one another closely. This makes sense, since they are means for describing different aspects of the same goal. However, because these data are ordinal, it is not possible to quantify the differences between the ranks, so these two scales are not necessarily equivalent. In other words, advancing from rank 2 to rank 3 at the tool level may or may not be as significant as a similar advancement at the activity level. Phases were coded independently on both of the hierarchies.

Research Questions

The research questions focus on the developing conceptualization of goal at the tool, activity, and goal levels of analysis, and how that conceptualization relates to performance in game set-up and play.

Research Question 1 – Relationship Between Goal Conceptualization and Performance

As research suggests, goals develop in step with understanding, consequently providing an expected route to changing goals that can be measured against expected performance. Thus, the first research question is:

Are conceptual differences in goal development at the tool and activity level, as measured by how children talk about them, related to observed differences in goal-directed activity, as measured by how children conduct their game play?

Research Question 2 – Influence of Task Phase on Goal

The sociocultural theory of activity explains that an active individual functions within a context of influences that include the task, the task rules and artifacts, the individual's conceptualization and sociohistorical background, social interaction with others, and the dynamic activity. The QP group is subject to the sociocultural influences of five distinct phases of the task: pre game set-up, game set-up, post game set-up, game play, and post game play. Variations in goal development across each game phase should reflect the influences within each context. Accordingly, the second research question is: Does the task phase influence participants' goal conceptualization?

Research Question Three - Influence of Researcher Questions

The questions posed by the researcher represent an additional potential contextual influence. Accordingly, the third research question is: Do repeated questions about goals from the researcher influence the development of children's goals?

Research Question Four - Process of Goal Development

Finally, the process of goal development is qualitatively examined. The cost of a dense sampling in terms of resources, as the microgenetic method requires, is that observation must coincide with the most dramatic episode of change. Consequently, a naturally occurring goal change within a short, predictable period of time must be identified. In this study, the most fundamental goal change was participants' shift from playing a game by conceptualizing the goal as a straightforward end to one in which the participant conceptualizes goal as a richer, more complex, and often indirect plan to reach the end-state. Thus, the final research question focuses on the goal conceptualization change process as children interact with the task.

Results

Verbalizations from children in the QP group were scored using the tool level hierarchy, and again using the activity level hierarchy, to provide a measure of goal conceptualization. The scores, consisting of a rank on the hierarchy, were gathered during three of the five task phases: pre set-up, post set-up, and post game play. Likewise, game measures for the game set-up and game play task phases were taken for both the QP group and the GPO group on each of the five sessions. Two measures were taken for game set-up: a score consisting of a rank from the tool level hierarchy, and the total number of smart set-ups incorporated into the participant's set-up (see Appendix C, Table 3).

Game play was measured by tracking and recording the type and number of move strings executed in each game, which was then converted into a proportion of the total number of move strings (see Appendix C, Table 4).

Research Question 1 – Relationship Between Goal Conceptualization and Performance

The first research question of this section regards the relationship between children's conceptualization of goal at the different levels of analysis and their game set-up and game play. In other words, does children's performance (game set-up and game play) match their goal conceptualization (stated ideas)? The results, illuminated by a multi-level analysis, suggest that children's goals are far more complex than their stated goal implies.

Interestingly, results found a great deal of variability between children's initial goal conceptualization level, which also manifested in their performance. This amount of variability was unexpected, since all the children in this study began the sessions as inexperienced Stratego players, and nearly all the children reported the same "goal" at the goal level, namely "to win" or "to capture the flag." This initial variability may support the assertion that children initially apply and adapt goals from other contexts to aid them in formulating goals in new contexts until they are able to internalize the use of tools specific to the new context.

Tool Level

Participant's goal conceptualization at the tool level correlated with their execution of goal in game set-up and game play (see Table 2). The tool level focuses on the developing conceptualization of task artifacts as means to the overall goal. The artifacts of Stratego function to support the goals of the task. However, participants' conceptualization enables and constrains how those artifacts are utilized. Participants with a less developed goal conceptualization use task artifacts like game pieces as a goal in their own right, expressing plans that follow from game rules but do not relate to a global goal. As experience and expertise grow, children begin to use some tools to support others, that is, they use some tools as means to the ends of other tools. This increasingly nested conceptualization of tools is indicative of individual's internalization of the tools into means to the overall goal. In other words, as Zinchenko (1981) asserted, goals change focus as operations become automatized. At the most developed level, individuals have internalized tools into their cognitive repertoire such that not only do they utilize their own tools, but also utilize their opponent's tools to reach their goal. Recall, the tool level hierarchy and its manifestation in set-up and game play are outlined in Appendix C.

Activity Level

Like goal conceptualization at the tool level, participants' goal conceptualization at the activity level correlated with their execution of goal in game set-up and game play (Table 2). The activity level focuses on the developing conceptualization of goal as comprising an informed, flexible plan or strategy. As conceptualization of goal develops at the activity level, children begin to utilize multiple sources of information to inform their conceptualization, namely from the task, the opponent, and their own strategies and plans. At the most developed level, information is acquired and accommodated from multiple sources and flexibly utilized to re-tune conceptualization during activity. Recall, a hierarchy describing this development can be found in Appendix C.

Research Question 2 – Influence of Task Phase on Goal

The goal level is focused on the sociocultural context brought to bear on the situation. In this study two major factors in the sociocultural context might affect children's goals at the goal level of analysis: the task phase and researcher questioning. Children's interpretation of their immediate context combines the explicit task, tools, and instruction with the implicit expectations and related issues, altering children's present goals. Research question two examines the influence of the different task phases on children's goal conceptualization and execution.

To say that goal develops at the goal level is somewhat misleading. More appropriately, changes to the sociocultural context are either accommodated by existing goals through adjustments at the other levels of analysis or usher in new goals. The different phases of the QP group's task contribute to the sociocultural milieu described by the goal level. As children respond to the demands of each phase, they formulate different goals regarding expected behaviors, task concerns, artifact availability, and personal concerns. These influences contribute to the development of goal, *yet may only be visible at the tool and activity levels*. In the Stratego game the task phases can be abstracted to their main motives: interpreting in pre set-up, planning in post set-up, doing during game play, and evaluating during post game play. Each phase provides a context that influences goal, or advances a less direct, contextual goal.

Pre Set-up Task Phase

In the pre set-up phase the context encourages speculation and interpretation of the context. However, because game activity has not begun and there is no interaction with an opponent or with artifacts of the game, this interpretation may be neither informed nor constrained, especially for a novice. The implicit goals of this phase are to interpret the context and answer the researcher's questions. When participants were asked their goal for the game, 97% stated some variation of, "To get the flag," or, "To win," parroting back the rule-based objective of the game. There was little variability in children's replies to this question, even in spite of the wide range of differences at the tool and activity levels of analysis.

Post Set-up Task Phase

The post set-up phase provides the best conditions for goal planning. The contextual focus emphasizes planning, and is supported by the prior activity with the pieces. During the prior phase, game set-up, children are provided with the artifacts of the game, i.e. the game pieces. During the game set-up task phase the children are presumably thinking about the game, at the very least to the extent necessary to place the pieces in the correct starting position. Further, although the post set-up task phase is not structured by the actual activity of game play against an opponent, children are anticipating game play. Consequently, the post set-up task phase puts the participants close to game play without exacting the cognitive resources actual play requires. The participants have all the task artifacts to support their thoughts, and researcher questions to prompt and focus their thinking, supporting the implicit goal of preparation to play.

These observations are consistent with the finding that participants scored higher average ranks during the post set-up phase than during the pre set-up phase. At the tool level of analysis the average goal

conceptualization score of the group over the five games were consistently highest during the post set-up task phase for nearly all participants. As a group, children's mean scores were higher during the post set-up phase than the pre set-up phase (Wilcoxon z(N=12)=-3.06, p=.002) or the post game play phase (Wilcoxon z(N=12)=-2.75, p=.006). The difference at the activity level between the phases is less dramatic. Post set-up task phase scores were significantly different from those in the pre set-up phase (Wilcoxon z(N=12)=-3.06, p=.002), but not compared to the post game phase (Wilcoxon z(N=12)=-1.47, p=.141).

Participants often changed their set-up while explaining their plan to the researcher during the post set-up task phase, suggesting that participants were considering their plans and the efficacy of their set-up. Participants were allowed unlimited time to set up. During this period researcher did not ask questions. Each participant was asked if he or she was done setting up before the researcher resumed asking questions in the post set-up task phase. Regardless, in 55% of the games, participants changed their set-up while explaining their plan to the researcher. Many of these changes entailed changes in the positions of many pieces.

Game Play Task Phase

The game play phase offers a context with real activity against a real opponent. Artifacts help guide and constrain thinking, but the ways they can be used are limited by the participant's set-up. This phase also encourages monitoring of performance. The implicit goal of this phase is playing the game; however what "playing the game" means may vary considerably given the added complexity of the context, and may be defined differently given each child's level of goal development. For example, one child, Ella, had not yet developed her goal at the tool level sufficiently to view artifacts as means; consequently she spent most of the game pursuing a goal of capturing all the opponent's pieces rather than capturing the flag. While capturing the opponent's pieces is a key subgoal and could, indeed, lead to capturing the flag, acquiring pieces unnecessarily creates opportunities for an opponent to execute a plan, reposition threatened pieces, and pursue the flag directly.

The goals of the game play task phase might include winning, capturing the flag, and accurately assessing the opponent's strategy. Because game play is a social and competitive interaction the implicit goals of monitoring self-esteem and having fun may also come into play.

Post Game Play Task Phase

In the post game play phase the opponent has left the room and the context emphasizes evaluation, speculation, and planning for the next game. The context involves neither game-specific activity nor support from game artifacts, although some participants spontaneously utilized the game pieces to illustrate their thoughts about the game and plans for the next game. The implicit goals during post game play were evaluation and planning for the next game.

One indication of the contrast between the post game task phase and the post set-up phase lies in the dramatic decrease in plan specificity. As children explained their plan to the researcher children expressed, on the average, M=1.37, SD=1.34 subgoals per game during the post set-up, but only M=0.78, SD=0.80 during the

post game (Wilcoxon T(N=12)=171.0, p=.233). This drop was more dramatic for children with higher ranking goal conceptualization. The high rank children expressed an average of M=2.5, SD=1.32 subgoals per game during the post set-up, but only M=1.1, SD=0.91 during the post game, whereas the low rank children only showed a slight decrease, from an average of M=0.80, SD=0.94 in the post set-up to M=0.63,SD=0.70 during the post game. This contrast between the performance of the high and low rank children is consistent with the possibility that high rank children are better attuned to the contextual influences that shape goal. In other words, high rank children form goals that are complementary to the context because they better utilize the context as a source of information. An alternative explanation of these findings should be considered, however. It is possible that the post game questions may have implicitly prompted the goal protecting the player's self-esteem. Thus, the low rank children may have provided less involved responses in order to avoid the topic.

Research Question 3 – Influence of Researcher Questions

The sociocultural demands of the two different game play conditions, namely differences between the QP group and the GPO group, illustrate the effects of interactions between the proctor and the participant on participants' goal in game set-up and game play. The interaction between participant and researcher was the only contextual difference between the two groups. Thus, researcher questions represent a form of intervention that could alter the direction or degree of development by emphasizing the goal/subgoal facets of the game or encouraging participants to reflect on their own thinking. Self-monitoring and other metacognitive activities tend to facilitate learning.

The sociocultural perspective, which emphasizes the roles of language and social interaction in cognition, suggests that the questions asked the first group of participants might serve to facilitate anticipated changes in goal development. While not intended as an intervention, prompting questions could function as an implicit guide to cognition by reminding participants about the order of events, by encouraging them to reflect about their own actions, and by emphasizing the goal/subgoal structure of the game. "From Vygotsky's point of view," Davydov (1995) writes, "...the teacher...using the possibilities of the social milieu in which the child lives (or in this case, plays), can only direct and guide the child's personal activity with the intent of encouraging its further development"(p. 17). Participants in the GPO group (no questions) experienced a context void of that influence.

In many studies the intervention of prompting questions may be regarded primarily as a source of invalidity. However, in this study researcher questions could accelerate a naturally occurring change. Some researchers have argued that using researcher questions in this manner does not unduly influence the course of development when used within the microgenetic method (Kuhn, Garcia-Mila, Zohar & Andersen, 1995). Others, however, have suggested that repeated questioning may affect the direction or degree of development (Klahr and Carver, 1995). And as Newman, et al. (1989) speculate, teachers may be able to imbue their charges with a specific goal by incorporating the goal into the sociocultural context through social interaction.

In this study researcher interventions were non-directive and did not imply or communicate a specific goal. Nevertheless, the questions asked by the researcher did imply that participants *should* have a goal, and possibly conveyed the message that it would be desirable to reflect about this goal at various points during game play. Consequently, differences between groups provide a good indication of whether non-specific interrogatives influenced goal development.

Results indicate that researcher questions had no significant influence on participant's goals. Game set-up rank scores for the GPO group ranged from 1 to 2.5 in game one (versus 1 to 3.5 for the QP group). And in game play, the proportion of advanced move strings (rank 3 or higher) that were executed by the GPO group in game one ranged from 0.06 to 0.50, compared to the game one range for the QP group of 0.0 to 0.67. The range of differences between participants remained largely consistent for both groups over the five games. Further, there were no significant differences between the two groups on average rank set-up (T=122.5, p=0.118), number of smart set-ups (T=154.5, p=0.817), or weighted smart set-ups (T=158.0, p=0.665).

Research Question Four- Process of Goal Development

This final section of the results describes change in goal conceptualization over the five games. As the previous results imply, conceptual change (verbalized or inferred from game play) may be visible only from specific levels of analysis and during different task phases. The pattern of conceptual change at the tool level was marked by a large increase between games one and two, followed by smaller positive changes. This pattern was also seen in children's game set-up. In contrast, the conceptual pattern at the activity level was one of vacillation in scores. This pattern was also seen in game play. Thus, patterns of change in conceptualization mirrored those in performance at the different levels of analysis, which follows from the results of research question one.

The pattern of vacillation appears immediately in game one for the QP group, yet appears to start later for the GPO group, past games three and four. This difference may indicate that children in the GPO group utilize the first few games to become accustomed to the game before considering a specific goal. In contrast, the children in the QP group may formulate goals from the start in game one, possibly as a result of guidance from researcher questions.

Changes in goal conceptualization indicate that the high rank children (those indicating high level goals) improved the most, and most large changes occurred at the higher levels of the score range, suggesting that improvement is more likely for children with an established knowledge base. Closer inspection of vacillation patterns imply a possible order to goal development in this context – from game play to game preparation, and from tool level to activity level.

The results also point to possible patterns in goal change. At the highest level of description (the goal level), children all pursued the same general goal, which was to get the flag and win. However, as earlier results indicate, the tool and activity levels of analysis reveal a more complex picture, in which children struggle to find the tools and route to the stated goal.

Based on children's talk and game play, four global categories of goal change were identified. Each category represents a distinctive pattern of goal change over the five games. The four categories are named based on the major activity comprising each category, namely: *focus, react, apply*, and *theory-build*. The first category, *focus* is characterized by the discovery of a local strategy. However, rather than applying that strategy to the global goal, children instead narrow their focus to applying and practicing the single strategy they have discovered. All subsequent plans focus on the local goal and how to most successfully achieve it. An example of the focus category is children's experience with the opponent's 10, the highest piece. Quite often an opponent will attack the participant's pieces with the 10 and completely dominate the game. Following an experience like this, participants in the focus category direct all their plans and strategies into "getting their (the opponent's) 10," losing sight of the overall goal of acquiring the flag.

The second category, *react*, is also one in which the individual changes by operating on local discoveries. In the case of the react category, children do not apply a single strategy globally or focus on it locally. Instead, children change their goal to accommodate every new situation they encounter, even within the course of a single game. The new situations they adjust for are those that, for whatever reason, they identify as the reason for the outcome of the game.

The third category, *apply*, is characterized by the discovery and application of a local strategy that subsequently gets applied on a global level. For example, losing the highest piece to a bomb through blind attacks often helps children discover that it is a mistake to attack the opponent blindly with their most valuable pieces. Children then apply this discovery as a means to achieving the global goal of acquiring the flag, e.g., by learning to explore with low-number pieces.

The final category, *theory-building*, differs from the other three categories in that, in this case, change is not prompted by the discovery of a single phenomenon. Theory-builders, instead, verbalize a plan that remains generally consistent throughout the games. Each day the plan is tested in game play, evaluated in the post game play, and modified the next day based on the child's assessment of the efficacy of the theory. Theory-builders sometimes begin with a theory that focuses on a local goal, which may initially lead in the wrong direction. At other times they state the global goal (e.g., to win, capture the flag), which may require more time to fill in the local strategies.

Children's verbalizations in the QP group fit into one of the four categories, some more precisely than others. The notable exceptions were children termed "learners." These children displayed instances of goal change behavior, but spent most of the five games simply (or not so simply) trying to acquire a goal, i.e. moving from a goal conceptualization rank of 1 to 2.

In all four categories, children's goals can be traced to a theme that evolves over the five games. For players in the *focus* category, this evolution becomes detrimental, locking them into a local strategy to the extent that the pursuit of the global goal is ignored or dismissed. In contrast to the near obsession displayed by those in the focus category, those in the *react* category abandon their plans constantly – almost whimsically. The

react category represents a slightly more advanced pattern of goal change than the focus category, but only because the excessive switching of goal sometimes generates a conceptually advanced goal to pursue.

Both the focus and react categories typically result in low level play. The *apply* category, on the other hand, is characterized by an immediate increase in a particular facet of goal development. Participants in this category may still conceptualize other facets of the goal at a lower level of play. An excellent example of a child in the apply category is Ally. Ally had never even heard of Stratego until game one. Her plan in game one scored a 2.0 at the activity level, consistent with the simple, offense-based plan that she expressed. During game play in game one Ally inadvertently feigns movement by touching a piece, but does not move it. The opponent, thinking Ally was going to move the piece, attacks it, only to find that the piece was a bomb. As a result, the opponent loses a high rank piece and irately claims that Ally cheated, despite her pleas of innocence. After all, Ally points out, she did not move the piece. Following this interaction, though, Ally applied this feint technique in every subsequent game, often with great success. In addition, not only did Ally apply the specific feinting technique, she also incorporated many other behaviors to utilize deceit to defeat her opponents. As she states in the post set-up of game two, "(My plan is) to fake them out...to pretend I'm going to move (my bombs)...Pretty much fake them out and sort of let him go first and that will sort of give me a hint as to where his flag is...And then I'm going to fake him out with little numbers, like say here's a 3 and...keep on moving toward him to make him think I have a high number. Like with the 2's. I only move one of them (multiple spaces, as opposed to moving all of the 2's more than one space a turn) so that way he wouldn't know where all my 2's are so he wouldn't know to go for them."

In spite of Ally's rapid improvement in goal, she continued to verbalize some low levels of game knowledge. For example, her description of masking the movement of the 2's so the opponent won't "go for them" implies that she thinks the 2's are a valuable piece to capture, which they are not. Ally's application of that single deceit strategy discovery in game one, however, appeared to lead to more rapidly learning the game and conceptualizing a complex goal.

The most advanced category of goal change is *theory-building*. Theory-builders methodically test and adjust their goals toward greater levels of complexity. Lou provides the best example of a theory-builder. Lou's initial plan in game one is to "figure out where he (the opponent) would put the flag by the opponent's moves, and after that I try to just go for the most common place, like the corner or the middle or the edges." He then assesses his plan in the post game by stating, "It was to either go for the middle or go for the space that his moves gave away. He was very good at this. He never gave any positions away at all." In the next game he displays the consistency of the theory-building category by maintaining the essence of his theory, which is exploring, but also takes a more active approach to exploring the opponent's set-up: "(My plan is to) take my 2's and scout out the area, then take 3's and get out all, clearing out the way with my 10 or my 9..." Lou assesses this game by stating in the post game phase, "He had the bombs well defending the flag. I didn't have the sense to bring my 3's out, which is what I should have done." In game three, instead of focusing on the problem that

emerged in game two (failing to use the 3's), he maintains his focus on his goal of exploring, adjusting it to the previous games. Lou's plan in game three is "to try and wipe out this middle area as much as possible because that tells you where all the bombs are and gives you access to all three of their rows." This pattern continues, reflecting a deliberate, mindful approach to building on prior experience and knowledge.

The overview of the four categories of goal change provides a qualitative view of goal conceptualization change in process. The four categories of goal change vary based on participants' abilities to identify and utilize information in the sociocultural context. Children at the lower levels of goal development pick up information that impedes their progress by distracting them from the overall goal, drawing them in to short-term goals that seem promising or productive but often are not. More often, however, children simply fail to spot the relevant information, a problem reflected in both the relationship between goal conceptualization and performance, and in the global categories of goal change just described. Further research is needed to determine whether these patterns represent different points on a continuum of change or learned heuristics that are more or less effective.

The evolution of most players' goals throughout the five games could be traced back as a variation of a single evolving theme. For example, Alex, a theory-builder, loses the first two games to opponents who send a high piece to attack. Alex's initial plans are offense oriented, but opponent play forces him to struggle with the idea of balancing offense and defense. This theme first manifests as relocating the flag and setting a trap for the opponent's 10. Then Alex picks up on the idea of using high pieces for offense and defense, putting "highish low" pieces (6,7,8) in front for offense and keeping the 9 and 10 "in storage." With this set-up, Alex's greater comfort with high pieces in reserve results in riskier single piece offensive moves and the quick loss of pieces in blind attacks. In this way, his initial struggle to balance offense and defense evolves to defending his offensive moves by sending out multiple pieces.

These themes often are initially generated at a single level of analysis. For example, Alex's theme of balancing offense and defense manifested at the activity level as he struggled to understand the relationship between set-up, play, and opponent. Other children, like Tom, begin to develop on a theme at the tool level. Tom fits into the focus category, and his theme for the five games was bombs. In the first game Tom guards his bombs and loses because the opponent tried "to get me over here by his bombs." In game two the opponent places two bombs in the front row in the center. From this game forward Tom's concept of the goal of the game is to get the flag by getting past the bombs. Consequently, his attention turns to the piece that defeats bombs, the 3. In game four the opponent captures all Tom's 3's right away as Tom blindly attacks what he assumes are bombs in the front row. From this experience Tom moves some 3's into a reserve position for protection. Interestingly, like Alex, Tom begins to balance offense and defense in set-up by varying the position of high pieces, and in play by first attacking with lower numbers and keeping some high numbers to use later in the game. Both players scored similar in goal conceptualization rank over the five games and ended at a similar understanding, yet each took a separate course at a different level of analysis, guided by their activity in the context.

Conclusions

The present study utilizes a sociocultural approach to defining goal and describing goal development. The multi-level approach of the Soviet model offers a unique perspective on children's goal and a means to describe goal development. This study is generally consistent with prior research that explored the process of goal development relative to the sociocultural context. However, the results also integrate the important contributions of the three major research approaches to goal: motivation, cognitive, and sociocultural. For example, the motivation approach focuses on goal as an independent construct, which helps define goal. Proximal, specific, and more clearly defined goals are more likely to be achieved, however these descriptors, when combined with a sociocultural approach, describe characteristics of context and/or artifacts that support a particular goal. Likewise, the early cognitive approaches viewed goal as inherent in a task. This view emphasizes the important role artifacts play in the goal process. By combining the insights of all three approaches one can begin to explain the complexity of how individuals conceptualize and utilize goal.

The first research question in this study highlights the importance and appropriateness of a multi-level analysis for defining goal, establishing a relationship between children's verbalized goal conceptualization at multiple levels of analysis and performance. The results suggest that children's goals are far more complex than their stated goal implies.

For practitioners, this relationship implies that children's verbalizations may provide important information about the most appropriate level of instruction, as well as hints about children's aims and general approach to a task. The multi-level approach to analyzing children's goals used in this study provides practitioners with a more complete view of children's goal development, particularly as it might help practitioners focus curriculum design toward either tool, activity, or goal level concerns. Although, it is important to also note that the task in this study accommodated verbal descriptions more than might tasks in other domains, i.e., in domains such as the kinesthetic where children lack the vocabulary to explain their physical goals, or on another level in a domain such as geometry where children are less able to utilize the sequential structure of language to express thoughts on problems that lack such structure.

The wide variability across children in goal conceptualization can be described as a shift in two dimensions: *external to internal, and static to flexible.* This is consistent with prior research noted earlier. External to internal refers to the extent to which participants' internalized the tools of the sociocultural context, utilizing those tools as part of their conceptualization of their goal. The static to flexible dimension refers to the capability of children to adjust their goals to new demands in the context. What the present research did not tell us is how goal conceptualization and performance influence each other, which researchers have speculated as a mutually reinforcing, bootstrapping process.

This research also investigated the relationship between influences present in the sociocultural context and children's goals. In this study, the social milieu at the goal level (the most global level in the Soviet scheme of multiple levels) is defined by the influences present in each of the task phases. These influences may include

the timing of the phase, the relationship of the phase to other activities, the researcher and his questions, the opposing player, the social interaction, and the artifacts of the context (in this study, access to artifacts differed in each task phase). The findings suggest that variations in context influence children's conceptualization of goal by introducing contextual influences that distract from the task goal, i.e., by supporting goals different from the task goal. More importantly, the variations in contextual influence occurred within the same task, emphasizing the fine distinctions that influence children with less developed goals.

While the long-term process of goal formation may be gradual, intermittent, and vacillating as described by Schauble, et al. (1991) and Siegler & Jenkins (1989); the short-term patterns of goal change may hinder development as expertise with lower level goals brings initial success and, consequently, less incentive to push to the next level. This phenomenon is evident in the play of participants like Cecil (in the react category), whose plans sound elaborate but who maintain focus on the local goals of individual pieces rather than incorporating those goals into the service of the overall goal, as participants at a higher level would do. Participants can, in fact, become quite sophisticated operating at a lower level perspective. For example, Miguel (in the focus category) had developed a very mindful approach to defeating known pieces. However, he had made limited conceptual advances in internalizing piece use into subgoals. Miguel became focused on a local goal, in this case capturing the opponent's 10. Consequently, he was easily overwhelmed and outplayed by any opponent who used coordinated play.

Thus, for Practitioners, a greater awareness of the extent to which the context might influence children's goals could be of great service in their efforts to create a more effective learning environment, particularly when combined with the facets illuminated by the multiple level approach. For example, this study showed how the task artifacts played a critical role in supporting children's early understanding of the goal of the task. Yet while those tools were a critical support, in a context emphasizing alternate aims, those tools were commandeered for those alternative aims, manifesting as "distracting" from the goal of the game. This would suggest that creating task artifacts to support children's initial learning of a task would provide children with concrete tools to facilitate their adjustment to the new task as long as proper care was taken to ensure the context supported the intended use of those tools.

Within a Stratego session, the post set-up task phase appears to elicit the most advanced levels of verbalized goal conceptualization from the children. Recall that this phase provides a context that best emphasizes children's planning for the game, e.g., all task artifacts available to support planning, no cognitive demands of game play, no socioemotional demands of interacting with the opponent, and situated as a phase just prior to game play. Further, not only do children do their most advanced work in the post set-up task phase, but also the results of goal change indicate that children also improve the most during the post set-up task phase. Practitioners might consider these findings by carefully examining the manner in which activities are executed and children are prepared to engage.

The Stratego task was also a significant part of the participants' context. As with any task, the characteristics of the Stratego task inform and limit goal development. Since any study of goals needs to be rooted in a goal about something, a task very different from Stratego, that is with characteristics different than Stratego, may lead to patterns of goal development different from those found in this study. For example, Stratego is a structured task that specifies a single goal. Thus, tasks with multiple goals, unknown goals, or a known goal requiring motivation rather than problem-solving or learning the task would perhaps show goal development that appears different than that found in this study. With the added complexity of multiple levels, further study of multiple, competing goals is even more intriguing.

The other facet of this research concerning the sociocultural context was the influence of researcher questions. While no effects were found in this study, prior research (e.g., Saxe, 1991; Newman, et.al., 1989) has pointed out the influential role of a teacher. In this study, the researcher interacted with the children a great deal throughout the sessions. If the children in this study showed no effects of this interaction on their performance or verbalizations, it was most likely due to the short duration of the study. Practitioners would be well advised to maintain an awareness of their influence on the sociocultural context.

Finally, this study found that children displayed particular patterns in their game play and talk through the five games. The qualitative description of change categories overviewed in the final section of the results (*focus*, *react*, *apply*, and *theory-build*) capture patterns of change at different levels of goal development, despite the goal level appearance of consistency across children's reported goals (i.e., the get the flag and to win). Verbal and game play protocols suggest that the children in each of these categories appear to fit patterns of goal change as measured by their goal conceptualization scores. The critical issue distinguishing these patterns of change lies in children's growing ability to appropriately identify and utilize information from the context, including the context during activity.

The process of goal change, as captured by the four categories, appears to be driven by shifting foci and shifting needs. Participants seem to pick up on a single facet of the game and eventually expand and grow their goal from that facet, much like the process goal-orientation theorists describe. Serving as a base, these initial goals transition into a means for other goals, bootstrapping goal development (via continued contextual interactions) from a single theme. This process may account for the dynamic nature of goals. However, participants seem to need a base of understanding on which to build, even though that base might be later abandoned.

Practitioners may find success following these patterns when introducing new tasks to children. For example, children in the study picked up on a specific discovery, generally at the tool level, during game play, and consequently built their goal off of that theme. Practitioners might find it successful to design curriculum and instruction to highlight children's discoveries in a way that supports children's growing understanding of the task. Further, the four patterns of change (i.e., focus, react, apply, and theory-build) displayed by the

children in this study may help Practitioners identify the less successful patterns, and provide instruction that either fills in the gaps of the less successful patterns or guides children to more effective patterns.

Combining the results with the qualitative patterns described reveals a more coherent view of children's goal development. Children are generally good at initially adjusting to a new goal, particularly to the more concrete demands of mastering the task artifacts. Of course, this description could apply to novices involved in any task, regardless of their age, but certainly the children in this study seemed unable to address the activity level until the tool level had been internalized as a base conceptualization. After children's initial adjustment to the goal at the tool level, however, they began the process of developing that goal. As participants in this study engaged in activity, a number of influences within the context competed for their attention. Through activity, children shifted their goal to better fit the demands and influences of the sociocultural context. Saxe (1991) found in his study of mother-child goal development that both mother and child adjusted their goals to better work with the other, reconciling old goals with new information. This same process is evident in participants' game play and talk. Tracking participants' talk from game to game reveals a chain of concerns that provide hints about children's changing conceptualization of the game. From the descriptive analysis it seems children hook on to a single experience from the activity that they feel is important and use that experience to build on. However, the constructive process may take on different patterns, i.e., *focus, react, apply, theory-build.*

The process of goal development, as indexed by the tool and activity level hierarchies, entails growth along the two dimensions of internalization and flexibility. Taken together, these dimensions of change generate the patterns described in the qualitative description of goal development. I have described this process as a growing ability to identify and utilize information from the environment. The separate levels of analysis, however, help parse the change process. As a group, high rank children showed most improvement at the tool level and vacillation at the activity level. However, low rank children, as a group, showed modest improvement at both the tool level and activity level. This suggests that the relationship between the tool and activity levels may not be the same at different points in goal development. The results suggest that children develop first at the tool level, and then at the activity level.

Further, children may bootstrap their development at the tool level into development at the activity level in a repeating cycle. Group change results hint at this cycle. Patterns of change at the tool level for children categorized as "learners" contributes additional evidence hinting at an alternating focus between tool and activity levels. Goal conceptualization scores for "learners" reflect patterns resembling the four categories, but only at the tool level of analysis. This suggests that the "learners" are also using patterns of change, but starting with the tools of the game and at a much lower level of play. These change processes and the behavior of "learners" emphasizes the growing evidence of the importance and influence of artifacts in the learning process.

While this study raises some interesting questions, the evidence converges toward the simple conclusion that goal is far more complex than children's stated aim. Numerous implications and applications for practitioners lie in a greater awareness of the complexity of goal, particularly the extent of goal using multiple

levels of analysis and its relationship to performance, the influence of the sociocultural context, and the dynamic, evolving patterns of goal development.

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Appendix A

Stratego Game Overview

The Stratego board game is a two-player strategy/war game played on a 10x10 grid (modified to 8x8 for this study to limit game play time and strategy parameters). Each player sets up and controls an army consisting of 24 pieces that are ranked like an army, with each rank assigned a number, 10 (Marshal) through 2 (Scout). Each player's pieces also contain four bombs, a spy, and a flag. Players arrange their pieces in three rows of eight so that the opponent cannot see their identity. Players take turns moving one piece a single space on each move. Pieces cannot move diagonally. Bombs and flag cannot move. The only exception to the movement rules applies to scouts (2), which can move any number of open spaces in a single direction during a given turn.

The object of the game is to capture the opponent's flag by outmaneuvering and/or defeating opposing pieces. When two opposing pieces occupy adjacent squares, one or the other may use the turn to "challenge" the opposing piece. The piece of higher rank number is victorious and the opposing piece is removed from the board. The two exceptions to the attack rule are bombs and the spy. Bombs defeat all pieces that challenge except for miners (ranked 3). When a miner challenges a bomb, the bomb is removed from the board. The spy defeats the highest ranked piece (10), but only if the spy attacks. The spy loses to any piece attacking it and all pieces it attacks except the 10.

Appendix B

Questions by Task Phase

Initial Screening

An initial screening of the child volunteers was conducted to identify those with limited experience playing Stratego. Experience was assessed by an interview with each child. The interview consisted of a few questions to establish rapport and four questions regarding game play strategy and rules. Children who were able to answer the final four questions correctly (those marked with an asterisk) were considered experienced and were thus eliminated from the participant pool. Experienced players (mean age 9.2) were asked to participate as opponents for the participant pool. Experienced players would more likely have an established conceptualization of the game and preferred strategies, thus limiting the opportunity to observe change. The following questions were asked at the initial screening:

How many times have you played Stratego?

When you play, what are you trying to do?

How do you do that?

What is your plan?

Tell me about a game you won.

*How did you do it? (Get the flag, plus multiple subgoals.)

*What is the best piece in the game? (Marshal or 10.)

*What piece defeats a bomb? (Miner or 3.)

*What piece defeats a 10/Marshall? (Spy, only if the Spy attacks.)

Participants answering all four asterisked questions correctly were considered "experienced," and were therefore assigned to the experienced opponent participant pool. Eighteen of the 24 eligible participants were unfamiliar with the game, and were unable to answer any questions correctly.

Question Protocol Group Sessions by Task Phase

The Question protocol group sessions included the five task phases outlined below.

Pre Set-up Task Phase

Prior to arranging their pieces for the game, participants were asked the following questions in the absence of the opponent (alternate questions listed in parenthesis were used for further prompting as needed):

What is your main goal for the game? (What are you trying to do?)

How are you going to do that? (Do you have a plan for that?)

How do you think you can achieve your plan?

Set-up Task Phase

Participants were then told to set up their game pieces in preparation for game play. No time constraints were put on the set-up task phase. The phase ended when the child stated that he or she was ready, either spontaneously or in response to researcher inquiry when it appeared the child was finished setting up.

Post Set-up Task Phase

Upon completion of set-up, the following questions were asked:

Tell me again, what is your plan for the game?

Does your set-up help your plan? Show me how.

What if that plan doesn't work? Do you have a back-up plan?

What do you think your opponent's plan is?

What do you think they will do?

Did you set up any pieces because of what you think your opponent might do?

Why did you place that piece there? (How will placing that piece there help your plan?)

The last question was asked for each of the following pieces: (a) flag placement and surrounding pieces, (b) bomb placements and surrounding pieces, (c) 10, 9, 8, (d) miners (3), and (e) the spy.

Questions were asked after, rather than during set-up because pilot testing found that participants were unable to simultaneously attend to setting up the game board and replying to the interviewer's questions. In some instances questions were followed by additional prompts to clarify a participant's initial answer.

Game Play Task Phase

Following the post set-up questions an experienced opponent was invited to the room to set up and play against the participant. During game play both the participant and opponent were allowed to talk freely. The researcher did not intervene, except to answer questions or to prompt continued play when the players were distracted or displaying misdirected behavior.

Post Game Play Task Phase

At the conclusion of the game the opponent was asked to leave the room. The participant was then asked the following questions:

What was your plan for this game?

Did your plan work? Why/why not? How?

Will you do something differently next time you play? What?

What do you think your opponent's plan was?

Why do you think you won/lost this game?

Appendix C

Goal Conceptualization and Performance Measures

The goal conceptualization measures were based on goal development hierarchies at both the tool and activity levels of analysis. Using information from pilot work, previous research, past experience with children's game playing, and knowledge of the specific task, hierarchies were created to provide structure to describe the development of children's explanations about their goals. These ordinal categories provide a means to quantify and analyze children's progress in developing their verbally stated conceptualization of goal.

Table 1

Tool Level Hierarchy of Goal Conceptualization and its Manifestation in Stratego

		Children's Statements about Game	
Rank	Rank Label	Set-up	Game Play
0	No response		
1	Unguided tool use	Random	Rule-based, rules without reasons.
2	Tools with immediate goals	High ranks in front 3's in front Bombs placed Minor flag defense (>2 pcs.)	Attack with 3 (blind) Blind attacks Immediate need defending Chasing Bombs as static Immediate defense
3	Tools with subgoals	Spy placement Bombs backed up with >3 Major flag defense (all) Each corridor defended (>6) High rank in reserve (>2 pcs.)	Blind attacks to area Some Scouting with 2 Spy obvious use Patient defense (tracking) Dual movement Bombs as temporary Defense as multistage

(table continues)

Table 1

Tool Level Hierarchy of Goal Conceptualization and its Manifestation in Stratego

		Children's Statements about Game	
Rank	Rank Label	Set-up	Game Play
4	Tools as means to end.	2's in front (>1 pcs.) Protection of 3's	Scouting with 2 Some coordinated movement Maneuvering with 2 Multipiece movement

			Spy discreet use
			Explorer-informed attacks
			3's as vulnerable and needed late in game
5	Own and opponents' tools	Deceit placements	Feints with B
		False Flag Bomb placement	False attacks/chasing
		Hidden Flag placement	Containing areas
			Statements of intentional deception
			2's moved single space to deceive

Table 2

Activity Level Hierarchy of Goal Conceptualization and its Manifestation in Stratego

Rank	Rank Label	Children's Statements about Game
0	No response	
1	Task without goal	Rule-based play, no plan.
2	Local strategies	Attack blind
		Chasing
		Confront invading pieces (blind defense)
		Focus on offense or defense, not both.
		Immediate need defending.
3	Emergence of a plan	Attack specific area blind
		Defend specific areas
		Focus on both offense and defense
		Reorganizing for defense / stalling
4	Goals becoming flexible	Explore, find identity
		Deceit statements to distract or mislead.
		Patient defense (piece tracking)
5	Goal flexibility	Deceptive moves
		Deceit statements intended to communicate a false plan.

Table 3

Smart Set-ups Description and Tool Level Rank

Piece/s Description	Tool Level Rank
Corridor blocking with bomb or high number.	Multistage defense. Rank 3.
Bomb backup. Numbers higher than 3 placed between bomb and flag.	Tool with subgoals. Rank 3.
Spy use. Spy near 10 or flag, and/or accessible.	Tool with subgoals. Rank 3.
Lake blocking use. Placement of flag or spy behind lake.	Multistage defense. Rank 3.
Offense/defense balance. High numbers in front and around flag.	Offense/defense balance. Rank 3.
Piece coordination. Cluster of high numbers with 2's and 3's.	Piece coordination. Rank 3+.
Scouting. 2's in front row or placed in a line.	Explore. Rank 4.
Placement deceit. Flag not in back row.	Deceit. Rank 5.
Deceiving that corridor is open. Deceiving that flag might be behind bombs.	Deceit. Rank 5.
Deceit false corner flag.	Deceit. Rank 5.

Table 4

Game Play Move Strings by Activity Level Rank

Rank	Move String	Definition
1	Stall	Moves on participant's side not fitting any other category.
2	Attack blind	Challenging unknown opponent pieces on opponent's side.
2	Defend immediate	Moving to defeat attacking pieces that do not pose an immediate threat.
2	Chase	Targeting and pursuing a specific known piece as it retreats.
2	Retreat	Moving pieces away from advancing opponent pieces while on opponent's side.
2	Defend retreat	Moving pieces away from attacking pieces while on own side.
3	Attack known	Pursuing and challenging known pieces.
3	Defend needed	Moving to defeat attacking pieces as they pose an immediate threat.
3	Balk	Moves on opponent's side not fitting any other category.
3	Prepare	Reorganizing pieces on own side to pursue a plan.
3	Maneuvering	Moves to get past opponent to some other destination.
4	Explore	Challenging unknown opponent pieces with low numbers to find identity of piece.
5	Deceive	Moves to deceive opponent, most often moves to imply an action that is not the true situation.

Table 1

Measures Overview by Grain Size and Task Phase

	Grain Size		
Task Phase	Tool Level	Activity Level	Goal Level
Pre Set-up	Rank	Rank	Stated goal
Set-up	Set-up rank		
	Smart set-ups		
Post Set-up	Rank	Rank	
		Set-up changes	
		Stated subgoals	
Game Play		Move strings	
Post Game Play	Rank	Rank	Attributions
		Stated subgoals	

Note. Rank scores were determined for verbal protocols based on the Tool Level Hierarchy and the Activity Level Hierarchy (Appendix C, Tables 1 and 2).

Table 2

Relationship between Goal Conceptualization and Activity – Results Summary

Tool Level Results (N=12)

Goal Conceptualization Measure	Activity Measure	r_s
Average goal conceptualization rank	Average set-up rank	.800**
Average goal conceptualization rank (ranked)	Weighted total smart set-ups (ranked)	.715**
Average goal conceptualization rank (ranked)	Advanced move string total proportion (ranked)	.747**

Activity Level Results (N=12)

Goal Conceptualization Measure	Activity Measure	r_s
Average goal conceptualization rank	Average set-up rank	.740**
Average goal conceptualization rank (ranked)	Weighted total smart set-ups (ranked)	.673*
Average goal conceptualization rank (ranked)	Advanced move string total proportion (ranked)	.729**

*p<.05, **p<.01

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